THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 20

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte CHIA-HUNG YANG

Appeal No. 95-4873
Application No. 08/174,723[1]

HEARD: October 13, 1998

Before URYNOWICZ, JERRY SMITH and BARRETT, Administrative Patent Judges.

URYNOWICZ, Administrative Patent Judge.

DECISION ON APPEAL

This appeal is from the final rejection of claims 7-14.

The invention pertains to a resonant-tunneling transistor. Claim 7 is illustrative and reads as follows:

7. A unipolar, three terminal, resonant-tunneling transistor, comprising:

a) a first terminal;

b) an insulating barrier on said first terminal;

[1] Application for patent filed December 29, 1993.

c) a first quantum well on said insulating barrier;

d) a first tunneling barrier on said first quantum well;

e) a second quantum well on said first tunneling barrier;

f) a second tunneling barrier on said second quantum well;

g) a second terminal on said second tunneling barrier; and

h) a third terminal on said second tunneling barrier, where said third terminal is electrically isolated from said second terminal.

The reference relied upon by the examiner is:

Yang et al. (Yang), “New field-effect resonant tunneling transistor: Observation of oscillatory transconductance”, Appl. Phys. Lett. 55(26), Dec. 25, 1989.

The appealed claims stand rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over Yang.

The respective positions of the examiner and the appellant with regard to the propriety of these rejections are set forth in the final rejection (Paper No. 10) and the examiner's answer (Paper No. 12) and the appellant's brief (Paper No. 11) and reply brief (Paper No. 13).

Appellant's Invention

Appellant discloses a resonant-tunneling transistor wherein a source terminal 7 is electrically connected to a quantum well 4 when majority carriers from the area of terminal 7 tunnel through the double-barrier resonant-tunneling barrier 5 to the quantum well 4. Transistor action is observed when the majority carriers propagate across the well and tunnel through the tunneling barrier 5 to the drain terminal 6 in a manner that results in a DC current gain. The transistor operation is controlled by a gate terminal 2.

The Prior Art

The reference to Yang discloses a field-effect resonant-tunneling transistor having a gate terminal (Back Gate), an n+ GaAs substrate, a 2.8Fm undoped AlGaAs and GaAs insulating barrier on the substrate, a 200Å n+ GaAs quantum well on the insulating barrier, a three layer, double-barrier, tunneling barrier on the quantum well, the tunneling barrier consisting of two 30Å undoped $Al_{0.37}Ga_{0.63}As$ barriers sandwiching a 70Å GaAs layer, a 1500Å n+ GaAs layer on the tunneling barrier and a capping layer on the 1500Å layer. A source terminal is located on the top of the structure. A drain terminal extends from the top of the structure through several layers of the transistor into the quantum well.

The Rejections

We note that appellant has not specifically argued the patentability of any specific dependent claim, indicating how it defines appellant's invention over the prior art. Accordingly, appellant's dependent claims 8-10 stand or fall with independent claim 7 and dependent claims 12-14 stand or fall with independent claim 11. In re Nielson, 816 F.2d 1567, 2 USPQ2d 1525 (Fed. Cir. 1987).

With respect to claims 7-14, appellant argues, among other things, that the third terminal of the reference, the drain, is not disclosed as being on the second tunneling barrier and that the reference has only one tunneling structure, that under the source, because the region beneath the drain (Ti/Pt/Au) is doped and is part of the drain.

Appellant's reply to the examiner's answer includes an affidavit of the inventor to the effect that the reference has only one tunneling barrier.

The examiner answers broadly that the claims do not recite tunnel structures but rather tunnel barriers, and that the claimed structure reads on the prior art regardless of the doping beneath the drain.

We will not sustain the rejections of claims 7-14 over the reference to Yang[2].

With respect to Fig. 1(a) of the reference, we agree with appellant that there is no tunneling barrier in the area of the drain of the reference which might be considered the second tunneling barrier of the claims. This is because of the n+ Si implant utilized to form the drain region, which region extends down into the 200Å n+ GaAs quantum well. The Yang publication discloses that the silicon implant is used to make shallow ohmic contacts to define the drain region. The only reference to tunneling is under the source terminal; tunneling is indicated by the hollow arrow under the source terminal of Fig. 1(a).

However, irrespective of the above analysis of the reference's disclosure, the first and second tunneling barriers of the claims read on those portions of the two 30Å layers of the double-barrier tunneling barrier under the source. The lower 30Å

[2] It is not clear from appellant's specification that the 100Å layer of undoped GaAs located between the two 30Å layers of undoped $Al_{0.4}Ga_{0.6}As$, which three layers form the undoped double-barrier resonant tunneling barrier 5, is a quantum well. However, we have concluded that this is the case from the construction of independent claims 7 and 11, and the fact that dependent claims 8 an 12 indicate that the second quantum well, like the first, is comprised of GaAs.

layer of the reference is a first tunneling barrier on the first quantum well, identified as 200Å n+ GaAs QW. The upper 30Å layer is a second tunneling barrier on the second quantum well, which is the 70Å layer of GaAs sandwiched between the two 30Å layers. Nevertheless, although the source terminal of the publication is a second terminal on the second tunneling barrier, the drain terminal of the reference cannot be the third terminal of the claims because the drain terminal is not on the second tunneling barrier. As indicated above, the n+ Si implant eliminates the possibility of a second tunneling barrier under the drain. In the area of the drain, the layer forming the second tunneling barrier under the source becomes part of the drain terminal itself. For the reasons given above, the rejection under 35 U.S.C. § 102 cannot be sustained.

Because the examiner has provided no motivation why one of ordinary skill in the art would have modified the prior art by eliminating the implant so that the drain terminal would be on the upper 30Å layer, the rejection under 35 U.S.C. § 103 cannot be sustained.

REVERSED

STANLEY M. URYNOWICZ, JR. Administrative Patent Judge	)	
JERRY SMITH Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
LEE E. BARRETT Administrative Patent Judge	)	

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